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ABSTRACT

This paper provides a conceptual framework for addressing the issue of effectiveness and efficiency in education. It considers alternative criteria for identifying efficiency and discusses constraints on improving efficiency. The first section distinguishes efficiency from effectiveness, and also distinguishes "internal" from "external" efficiency and effectiveness. The inputs of the system determine whether the term "efficiency" or "effectiveness" is to be used; the outputs determine whether the descriptors "internal" or "external" are applied. In most cases, nonmonetary inputs imply effectiveness, while monetary inputs imply efficiency; similarly, nonmonetary outputs imply internality and monetary outputs imply externality. Three issues are indirectly related to the measurement of effectiveness and efficiency: the broader consequences of education, equity considerations, and specification of qualitative versus quantitative outputs. Constraints on improving efficiency include inadequate knowledge about internal effectiveness, inadequate knowledge about costs of inputs, and difficulty in obtaining appropriate information. References are included. (TE)

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THE MEASUREMENT OF EDUCATIONAL EFFICIENCY AND EFFECTIVENESS

Introduction

The terms "effectiveness" and "efficiency" are used in many ways, although the concept unifying these discussions is very simple. When there are limited resources--as there always are--those resources should be used to promote society's objectives as fully as possible. Concern with effectiveness and efficiency in education, therefore, has to do with using the resources available to education to promote society's educational objectives--for example, basic literacy and numeracy, civic responsibility, religious piety.

This paper (a) provides a conceptual framework for addressing the issue of effectiveness and efficiency in education, (b) considers alternative criteria for identifying efficiency, and (c) discusses constraints on improving efficiency.

Effectiveness and Efficiency defined.

Efficiency refers to a ratio between inputs and outputs. A more efficient system obtains more output for a given set of resource inputs, or achieves comparable levels of output for fewer inputs, other things equal (For technical discussions, see Hanushek, 1986; Levin, 1976; Levin, 1983; Pogrow, 1983; Rossmiller and Geske, 1976). The output of education refers to that portion of student growth or development that can be reasonably attributed to specific educational experiences. These

include the development of literacy and numeracy skills, positive attitudes toward work, civic responsibility, and a myriad of other skills, attitudes and beliefs.

This definition departs sharply from the practice of considering the number of graduates the output of the education system. Instead, it focuses attention directly on the net improvement in skills resulting from being educated. This approach is often referred to as a "value added" approach, which separates the effects of schooling (or other educational experiences) from parental and background effects.

Educational efficiency is frequently confused with educational effectiveness, or the two terms are used together. Yet, as Levin has clearly demonstrated with respect to selected educational interventions, what is most effective is not necessarily what is most efficient (Levin, Glass & Meister, 1984). The distinction between efficiency and effectiveness -- and a further distinction between "internal" and "external" effectiveness or efficiency -- is provided by the following unconventional but convenient classification, based on the indicators of inputs and outputs. The <u>inputs</u> of the system determine whether the term "efficiency" or "effectiveness" is to be used. The <u>outputs</u> of the system determine whether the descriptors "internal" or "external" are applied to efficiency and effectiveness. In the vast majority of cases, non-monetary inputs imply effectiveness and monetary inputs imply efficiency; similarly, non-monetary outputs imply internality and monetary outputs imply externality. In some cases, however, non-monetary outputs may imply externality, as, for example, when child

nutritional status is related to maternal educational attainment.[2] Figure 1.1 provides a schematic representation of these distinctions.

Figure 1: Internal and External Effectiveness and Efficiency of Educational Systems

How are inputs measured?	How are outputs measured? Non-Monetary terms (eg: learning) #	Monetary terms (eg: earnings) $
Non-monetary terms (#) (eg: number of text-books, classroom organization)	INTERNAL EFFECTIVENESS[a] technical efficiency: #/#)	EXTERNAL EFFECTIVENESS ($/#)
Monetary terms ($) (eg: cost of text-books, teacher salary)	INTERNAL EFFICIENCY (effectiveness-cost: #/$)	EXTERNAL EFFICIENCY (benefit-cost: $/$)

Note: All ratios refer to the ratio of outputs to inputs, expressed in either non-monetary (#) or monetary ($) terms.

a> a system is more internally effective (technically efficient) than another if, to produce the same level of output, fewer of at least one input are used.

b> a system is more internally efficient than another if, to produce the same level of output, it is less costly.

Internal effectiveness. I use the term "internal effectiveness" to refer to a ratio of learning (a non-monetary outcome of education) to specific inputs of the system. The inputs of education include both material and non-material resources, with the latter term used to encompass pedagogical practices and the organizational structure of schools and school systems, as well as such items as teacher time and ability. Material inputs include such items as textbooks, instructional materials, desks and classrooms. I do not restrict the term "inputs" to only those inputs which can be expressed as physical quantities or in monetary terms. In fact, I specifically include the complex interactions of students and teachers as elements of input, even though they are best expressed as processes rather than inputs. Internal effectiveness is also referred to by economists as "technical efficiency": the organization of available resources in such a way that the maximum feasible output is produced (Levin, 1976)."

Internal efficiency. Similarly, I use the term "internal efficiency" of education to refer to a ratio of learning (a non-monetary outcome of education) to the costs of educational inputs; the analysis typically employed is cost-effectiveness. Internal efficiency addresses the question of how funds within the educational sector should be best allocated. It is concerned with obtaining the greatest educational outputs for any given level of spending. Economists have a simple conceptual rule to determine how resources should be allocated among alternative educational activities: The improvement in educational performance that results from the last amount of funds spent on

an educational activity should be equal across each possible activity. For example, consider a school that is deciding between buying new workbooks for students and hiring a part-time teacher to tutor individual students. Clearly, the school should spend the funds on the one that increases performance the most--say workbooks in this example. In fact it should continue spending money on workbooks until the educational value of the two choices is the same. (After the initial purchase of workbooks, the value of added workbooks is probably lessened so that at some level of spending the appropriate decision is to purchase a tutor instead of more workbooks.) The same logic holds for all of the inputs that a school purchases, leading to the previously stated rule. Internal efficiency is also sometimes referred to as "allocative efficiency" or "price efficiency" (Levin, 1976).

External effectiveness. External effectiveness has to do with the relationship between non-monetary inputs and monetary outputs. In education, this could refer to the degree to which certain pedagogical practices or school tracks affect student post-graduate salaries, other things equal. Studies contrasting the earnings of technical-vocational track graduates with the earnings of students graduating from academic tracks are examples (e.g., Psacharopoulos and Loxley, 1985). Such analyses are usually conducted as a first step for "cost-benefit" analyses.

External efficiency. By external efficiency, we refer to what is often the topic of cost-benefit analyses: that is, the ratio of monetary outcomes to monetary inputs. Extensive

consideration has been given to the issue of "external efficiency", or how the overall use of money for schooling compares to other potential public and private uses. If a country received $1 million, should it channel this to education or to some other expenditures? The answer depends crucially upon a comparison of the benefits of the alternatives. In perhaps the simplest consideration, one can calculate the rate of return to an investment in education and then compare this with an alternative investment. This is complicated--in large part because the calculation of benefits is frequently difficult--but it has proven to be a very useful approach for policy considerations.

The analysis of external efficiency provides information that is useful in deciding upon the right level of educational spending for a country, or in deciding upon the allocation of funds across different subsectors such as primary education or vocational training. It does not, however, provide guidance about the specific policies that should be pursued within the educational sector. This guidance is provided through analysis of internal efficiency.

Efficiency related to alternative criteria

Three issues are indirectly related to the measurement of effectiveness and efficiency. These are: the broader consequences of education, equity considerations, and specification of qualitative versus quantitative outputs.

Broader consequences. The rationale for investing in education often has to do with its indirect effects on desirable

social goals--that is, it improves individual productivity, nutrition, and health; it aids in achieving other societal goals, such as fertility objectives; it relates to income distribution concerns; and so forth. These objectives are mediated by different direct outputs of the education system: cognitive skills, attitudes and behaviors. A direct implication of this is that different conclusions regarding effectiveness and efficiency will be drawn, according to the particular outcome criteria that is chosen.

It is not difficult to develop effectiveness and efficiency analyses when there are means of directly comparing benefits in different dimensions, such as by placing a monetary value on each output. The required weights for such alternative outputs as literacy, numeracy and civic responsibility, however, do not generally exist, and hence effectiveness and efficiency analyses typically address single outputs only.

Equity. A second and more fundamental issue in analyzing effectiveness and efficiency is the general neglect of any distributional matters, since both effectiveness and efficiency considerations gloss over who benefits. If, however, there is a systematic distributional component that differs across policies, the most "effective" or "efficient" policy may not always be the optimal policy for society. (Typically, economic analysis would presume that resources should be employed in their most productive use, maximizing the total amount of output. Then, if redistribution is a separate goal, other policies should be pursued to attack that area directly. Various political or cultural constraints might, however, make these latter policies

difficult.)

Quantitative outcomes. Educational research and evaluations related to effectiveness and efficiency are highly dependent upon the output measures that are used. The most common measure used in research in developing countries is counts of students: enrollment rates by ages, grades, or level of schooling; continuation rates or dropout rates at specific ages or grades; and repetition or completion rates by grade or level. Each measures some aspect of the flow of students through schools.

None of these measures is appropriate for judging the internal effectiveness or efficiency of schools. Measures of the quantity of schooling received by children is most useful for making aggregate comparisons, say across countries or across regions within a country; they are much less useful within a country where the issue is differential performance by schools. Quantitative measures of participation or progress obscure differences in the achievement of children within the same grade of schooling, but these latter differences are more important for judging effectiveness and efficiency.

Moreover, it is very possible to develop policies that, for example, increase the continuation rates in schools but do so at the expense of children's learning. The quantity of schooling is obviously related to the amount children learn, but the relationship is not consistent across children, schools, and countries. All available evidence suggests clearly that policies to increase the amount of primary schooling, and thereafter secondary schooling, are desirable. This does not, however, mean that all "improvements" in quantity mark "educational"

improvement, since some might not be warranted if learning declines as a result. For example, repetition rates in primary grades can be changed by direct governmental policy; yet lowering repetition rates in a mechanical way might reduce the amount students learn.

The popularity of quantitative measures is clearly related to their availability, not their conceptual desirability. While they may be useful for aggregate and cross-national comparisons, they cannot provide real guidance to the efficiency discussions here. The important issue is the different kinds of policy discussions and deliberations that are being considered. For a country that does not have universal primary education, expanding exposure--almost regardless of quality considerations--is likely to be an appealing policy. But once general exposure, which can be justified on equity grounds, is reached, educational policies switch from purely quantity considerations to differential quality.

Learning outcomes. The most commonly used measures of school performance are scores on standardized achievement tests. By standardized tests we refer to tests that are constructed, administered, scored, reported and interpreted in a consistent fashion to provide for the measurement of individual differences in as unambiguous ways as possible (Anderson, Ball & Murphy, 1975). Properly treated standardized tests provide consistent information across schools, as well as indications of performance differences among children within the same school. Although studies linking performance on standardized tests and subsequent outcomes are few, when tested, there is a strong positive

relationship between test scores and subsequent labor market earnings (see Boissiere, Knight and Sabot 1985).

At primary levels, standardized tests provide good indicators regarding student attainment of principal educational objectives: functional literacy and numeracy. In later grades, where other objectives of schooling increase in importance, standardized tests covering the entire curriculum are more difficult to construct. In higher education there are very few cases in which learning outcomes have been successfully measured.

Constraints on improving internal efficiency.

Efficient use of resources is especially important in the case of education in developing countries. Most countries make education a priority spending item, and education tends to consume large portions of governmental budgets. Yet education must compete with other uses of funds, both public and private. In times of fiscal pressures on governmental budgets--whether these arise from poor performance of the economy or from the competition of other governmental programs--education spending comes under intense scrutiny. If it appears that funds allocated to schooling are being wasted--inefficiently used--arguments for cutting back expenditures are strengthened.

Internal efficiency of education can be improved in two ways: (a) by reallocating resources from inputs that have smaller effects on learning to those than have larger effects on learning, that is, by increasing outputs associated with given levels of resources, and (b) by reducing overall resources while maintaining existing levels of learning.

Improving efficiency has obvious appeal, particularly in the face of the fiscal pressures facing most school systems. But there are many reasons why it might not be achieved; this discussion identifies three of the more important ones: (a) inadequate knowledge about internal effectiveness, (b) inadequate knowledge about costs in inputs, and (c) difficulty in obtaining appropriate information.

Effectiveness of inputs. Informed policy making requires information about the effect on educational outcomes of adding (or subtracting) every possible educational input (that is, knowing the internal effectiveness of all resources). These informational requirements are obviously very large. Such information can come from many sources: educational experiments, research into scholastic performance, or experience and observation. Each source has its advantages and disadvantages, but none is likely to provide a complete picture.

Educational administrators, policy makers, and researchers must each be able to separate the influences of the different inputs to the educational process in order to judge their effectiveness. This is frequently very difficult to do because inputs tend to be related to each other. For example, well educated parents are likely to provide learning in the home and send their children to schools having more resources and better trained teachers. Similarly, illiterate parents in developing countries are likely to send their children to schools having few material resources and poorly educated teachers. In both cases, it is difficult to separate the influence of specific school inputs from each other or from that of parents. Other examples

pointing to the difficulty in separating the distinct inputs to education are easy to develop.

Current knowledge of the educational process in developing countries is actually quite primitive (see Fuller, 1985, for a recent review). The effectiveness of some inputs is known, but the evidence is not very precise. The result is that inefficiency can be very large simply because there is insufficient information upon which to base policies.

Costs of inputs. A second element needed for policy and analysis into the internal efficiency of the educational system is the cost of separate inputs into the process. If there are several inputs known to be beneficial to education, the efficiency criterion would dictate allocating resources in a way that also considered costs. Specifically, more expensive inputs should be more effective in order to compensate costs.

The estimation of costs of inputs, while apparently quite straightforward, can be very difficult. Costs must be directly linked to the inputs identified in the effectiveness discussion. If attempts are made to describe inputs in great detail--perhaps linking process choices of teachers and the like--the costs must relate to providing inputs of such a description. This rapidly exceeds our abilities, because little is known about the supply of many of the inputs. For example, the supply of teachers with a given level of schooling has been estimated as a function of salaries; the supply of teachers with a given schooling and verbal ability level, with a pedagogical style emphasizing student questioning, with a fluency in several languages, and so forth has never been systematically studied. Most cost

estimates, therefore, are very general.

Difficulty of obtaining information. The difficulty in developing better information about the educational process reflects several factors. First, the complexity of the problem means that any research/information gathering effort must be quite sophisticated, utilizing multiple instruments to measure both inputs and outputs and employing complex research designs. To fully identify relationships, experimental designs with effects traced over several years are desirable. Such projects are rarely undertaken anywhere, and are virtually unknown in educational research in developing countries.

Second, systematic analysis of the type needed to support large policy initiatives is costly, thereby making it an appealing target in times of fiscal stringency. It is noteworthy that, while the World Bank has invested over $10 billion in education projects, research necessary to answer questions about the internal efficiency of education has been conducted in fewer than half a dozen instances.

Third, and perhaps most fundamentally, the nature of schooling in the countries where studies have been undertaken may obscure any basic relationships. If identified inputs into the educational process do not have a consistent relationship with educational outcomes, observations of the inputs by different people at different times could yield mixed findings. Such could be the case if the educational system exhibited a noticeable degree of technical inefficiency (internal ineffectiveness); that is, if inputs were not used in such a manner as to achieve the maximum feasible output. For example, a textbook in the wrong

language or a teacher improperly prepared for a specific subject would almost certainly be worse than if these were appropriately arranged. In some schools (those using the correct books) it might appear that textbooks were a very effective educational input, while the experiences of other schools (those using the wrong books) might suggest no impact of textbooks. Technical inefficiency, which is essentially the wastage of specific resources, makes it difficult to predict or evaluate the potential advantages of different policies.

Technical inefficiency can exist for a wide variety of reasons. It might reflect historical but outdated policies; overt and knowing waste; or simple mismanagement.

But it might also reflect the complexity of the educational process and the difficulty of properly identifying effectiveness in both research and policy analysis. In the simple example above, it could be that properly measured inputs of textbooks (such as an appropriate arithmetic book in the correct language used immediately after the previous text in the same series) has a consistent effect on achievement, even though simply measuring the presence of any book in the school has no consistent effect. The case of teachers is much more complicated because the possible identifying characteristics make up a very long list--one far exceeding any available analysis.

The underlying requirement in measuring effectiveness and in evaluating potential policies is the identification of a given set of inputs that have a homogeneous relationship to student outcomes. Doing this might involve specifying complicated interactions among teachers, the various process choices they

make in the classroom, and the environment of the schools and macro process choices. The more complicated this is, the less likely any research is to be successful and the less likely it is that fully articulated policies can be developed.

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